A STUDY OF SLEEP QUALITY AND OCCUPATIONAL FATIGUE AMONG HEALTHCARE PROVIDERS WHO WORK SHIFT DUTY IN EMERGENCY DEPARTMENT, HOSPITAL UNIVERSITI SAINS MALAYSIA IN THE YEAR 2014

BY

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Health care workers generally are under tremendous stress. This is especially true in the emergency department where the Emergency Medical Services (EMS) workers are constantly under significant pressure with regard to health care and responsibilities. Healthcare providers in Emergency Department are required to deliver critical around-the-clock or “24/7” operational care to a variety of patients.

The emergency department (ED) presents a real risk factor for cases of burnout because it generates more stress than any other department (O. Fernández Martínez and García, 2007). This is evidenced by increased pressure on health care, patients demanding a reduction in waiting time, long working hours, few breaks and a lack of cooperation from patients and their families. EMS workers are constantly and increasingly faced with difficult clinical cases and workloads that are taxing physically, mentally and emotionally. There are also lots of civil and legal responsibility associated with medical work, residents are frequently at risk and in potentially dangerous situations, constantly feeling rushed and harassed (O. Fernández Martínez and García, 2007).

Providing quality health care services requires EMS providers to attend to details critical for life, such as monitoring of changing vital signs, administering the correct type and dose of medications, and in general, making crucial decisions to achieve optimal patient care. They are regularly required to problem-solve delicate and complex issues, in an independent, self-governing and timely fashion. They are also required to perform clinical skills, procedures and driving with professionalism and care. Their management is crucial during treatment of critical patients, where skills are paramount and errors in judgment or lapses in concentration could end up having fatal consequences (Frank Archer, 2012).

EMS workers work along a continuum of clinical skills that can be practical or emotional in nature. EMS workers are faced with the palliative and terminal patients, as well as the emotions of the patient, family and friends as these individuals face their mortality. Furthermore, violent and agitated patients are also a challenge to EMS workers, these patients can be drug/alcohol affected or living with mental health issues. Such patients must be approached with caution, as unfortunately assaults and abuse of EMS workers is not uncommon (Frank Archer, 2012). In addition to dealing with volatile and delicate situations, EMS workers are aware that they are also exposed to illness and disease, which can affect their health or the wellbeing of their own families (Frank Archer, 2012).

Besides that, as EMS workers, they need to be on their toes whenever they are on duty. They have to be on standby mode at all times and get ready to deal with unpredictable patients with various kinds of diseases, illness, injuries, accidents and even disasters. They are required to work in a fast-paced situation with unpredictable flow of work. In addition, there are always problem with patients overcrowding (Trzeciak and Rivers, 2003). ED overcrowding refers to an extreme excess of patients in the treatment areas, exceeding ED capacity and frequently necessitating medical care to be provided in ED hallways and other makeshift examination area (Gordon *et al.*, 2001). ED overcrowding is largely attributed to inappropriate use of ED by a large volume of non- urgent patients and there is always a problem with inadequate inpatient capacity causing “boarding” of patients in ED (Kellermann, 2000).

Usually there is diurnal variation of salivary cortisol and melatonin level consistent with normal circadian rhythms (Machi *et al.*, 2012). This cortisol levels are supposed to be highest in the morning and lowest between about midnight and 4 am. Cortisol level will usually rise above the normal level to help us cope with severe stress. This raise in stress-response hormone or serum cortisol level is highly energizing and will result in anxiety and insomnia. If levels are too high, the person will feel wired, tense and hyper-vigilant. However, for EMS workers who are working shift, this circadian rhythm is disrupted.

Shift workers frequently experience sleep loss, circadian disruption, and fatigue. The challenging working environment in ED always cause EMS workers to have adrenaline rush or increased stress hormones like cortisol. Therefore, it is not surprising that EMS workers are always complaining of fatigue due to their sleep problem. Machi *et al.* (2012) indicated that morning cortisol peak was decreased or delayed in samples from physicians after a night shift causing them to have impaired short-term memory after day and overnight shifts with higher incidence of disturbed sleep in this population. Shift work and long work hours increase the risk for reduced performance on the job, obesity, injuries, and a wide range of chronic diseases (Miller, 2010b). In addition, fatigue-related errors could harm patients. Fatigued workers also endanger others during their commute to and from work. Commonly identified errors in EMS providers include deviating from protocol, failure to secure a patient’s airway, dropping a patient from a stretcher, and mistakes in administration of medication (Patterson *et al.*, 2010).

Sleep deprivation due to extended work hours and circadian disruption has long been a concern in medicine. Sleep research shows that the average adult needs a range of 7 to 9 hours of sleep each night (Ferrara M, 2001). Poor sleep, increased sleep fragmentation, late bed times and early awakenings are found to seriously affect learning capacity, school performance, and neurobehavioral functioning (Dewald *et al.*, 2010). According to Curcio G (2006) sleep is an active, repetitive and reversible behavior serving several different functions, such as repair and growth, learning or memory consolidation, and restorative processes (Curcio G, 2006). Therefore, even minimal levels of sleep loss can lead to impaired judgments and altered moods. Fatigue and sleep disturbance are factors which can compromise the effectiveness of these workers, and as a result not only hamper patient safety but can have detrimental consequences on the workers’ health and overall well-being.

Between 20% and 30% of workers leave shift work within the first 2 to 3 years because of ill health (Härmä, 1993). Gastrointestinal disturbances (eg, dyspepsia, constipation, and diarrhea) are common complaints (Reinberg A, 1983). Both the risk of preterm birth and retarded fetal growth has been linked to shift work (Armstrong B, 1989). Female shift workers are 1.6 to 1.9 times more likely to give birth prematurely and 1.4

times more likely to have low birth weight infants (Mamelle N, 1984). The risk of pregnancy loss was 4 times higher among women with fixed evening work schedules and more than twice as high in women working fixed night shifts in comparison with women working fixed day shifts (Infante-Rivard *et al.*, 1993). Shift work affects health and well-being both physiologically and psychologically, which translates from work into home. In addition, shift work is also associated with lots of other problems, such as cardiovascular disease, gastrointestinal disease, increased accident risk, disturbed sleep and increased fatigue.

1.2 Problem Statement

Emergency departments (EDs) provide care for patients at all times. To provide continuous service, healthcare workers (HCW) in ED typically work rotating day, afternoon, and overnight shifts. It is well known that shift work, with the demands of family and recreation lead to irregular sleep patterns, prevent restful sleep and thus fatigue. Shift work not only causes sleep deprivation and desynchronosis or dysregulation of the circadian rhythm (Winget *et al.*, 1984), it also has detrimental effects on the workers' physical health (Kuhn, 2001), mood, concentration, memory recall, as well as their quality of performance at work. This has implications not only for patient safety, but also for HCW career longevity and workforce turnover (Machi *et al.*, 2012).

Working on shifts can alter our normal sleep schedules, causing partial sleep deprivation on workers and disrupting their circadian rhythm (Weinger and Ancoli-Israel, 2002). In short, twenty-four-hour activity makes EDs prone to the errors that arise from contradicting circadian rhythms. Sleep deprivation can affect clinical performance and may be an important factor in patient safety. Error in EM differs from error in the rest of medicine for a number of reasons. First is the nature of a typical ED, where time pressures are more intense than on unit floors, and where medical history is less easily accessible than on wards or in operating rooms. There may not be time in an ED, for example, for a drug order to receive central pharmacy review before delivery (Ammons DK, 1997).

Furthermore, inconsistent arrival of patients means that ED staff may be bored and less attentive during slow periods or, more likely, harried during busy periods. In addition, most high-risk patients pass through ED on their way into the hospital; these patients require more individual procedures and decisions and are, therefore, exposed to more possibilities for error. As if these were not enough, EDs tend to be environments in flux, where patients may be in any of a half-dozen locations in a room, in a hallway, in radiology, in CT, in a procedure room, or in observation and where staffs rotate on every shift.

Shift workers reportedly sleep 1-4 hours less than day-workers which mainly affect stage 2 and REM sleep (Åkerstedt, 1990). This suggests the possibility that the majority of shift workers could be facing continual accumulation of sleep debt. A sleep deficit would only compound the risk of associated fatigue-related error and accidents in the health care context of patient safety. Renowned sleep researcher Drew Dawson found that approximately 20–25 hours of wakefulness produced performance decrements equivalent to those observed at a blood alcohol concentration (BAC) of 0.10, with 17 hours of sustained wakefulness observed at an equivalent of 0.05 BAC (Dawson and Reid, 1997). These figures are of concern, as both the safety of paramedics and the ability to provide health care to the highest standard to patients is being highly compromised.

The 24-hour physician coverage of the emergency department (ED) requires shift work, which can result in desynchronosis and cognitive decline. Machi *et al.* (2012) measured changes in cognition and sleep disturbance in attending emergency physicians (EPs) before and after day and overnight shifts. Medicine is an industry in which public safety is directly affected. An estimated 108,000 people die each year from potentially preventable iatrogenic injury. One in 50 hospitalized patients experiences a preventable adverse event (Leape *et al.*, 1995). The Harvard Medical Practice Study reported that 3% of adverse events uncovered occurred in EDs.(Leape *et al.*, 1991) The reviewers found a relatively high rate of adverse events due to negligence, especially associated with misdiagnosis in EDs.

A study was done by Smith et al to examine the effects of sleep disturbance of experienced physicians in ED. Performance on a psychomotor vigilance task and mood were impaired, and the time required to intubate a mannequin was significantly slower during the night shift when compared with the same physician’s performance on a day shift

(Smith-Coggins *et al.*, 1997). Thus, patients' life is at stake if the healthcare workers are being called to treat patients when they themselves are fatigued and at a low point in their ability to function on a cognitive level.

Macias DJ (1996) also determined that hospital employees had a higher rate of exposure to biological fluids, such as needle sticks and splashes, during the first hour of any shift and during the last two hours of a 12-hour shift. While the results presented are generalized, with only a fourth of incidents arising in an ED, this study suggests the challenges inherent in shiftwork and the lapses that can occur around change of shift.

Besides that, World Health Organisation (WHO) also identified fatigue as the leading factor in medical error and injury in healthcare (WHO, 2009). On a financial basis, for hospitals, burnout, stress and fatigue can be costly leading to increased employee tardiness, absenteeism, turnover, decreased performance, and difficulty in recruiting and retaining staff (Warltier *et al.*, 2002). Based on the preceding studies, it seems unlikely that healthcare organizations with high levels of burnout among health professionals could achieve the performance characteristics such as patient-centeredness as a strategy to improve quality of care (Wolf *et al.*, 2008).

1.3 Significance of the Study

A recent study determined that a high proportion of Emergency Medical Services providers suffer severe fatigue while at work and generally have poor sleep quality (Patterson PD, 2010). Analyzing the prevalence of fatigue within a healthcare organization is an essential first step for organizations that aim to implement stress reduction programs and establish positive work environments for their workers. The purpose of this study is to assess the quality of sleep and fatigue level among the healthcare workers in Emergency department, and this may help the authorities in future policy making.

Healthcare professionals need to recognize the essential need for sufficient sleep in maintaining optimal health and performance. They must be aware that sleep disorders is an important source of stress, fatigue, adverse health outcomes and as a potential cause of medical errors and adverse patient outcomes. Recently, patient safety has taken center stage in health care. The Institute of Medicine's report "To Err Is Human: Building a Safer Health System," revealed that medical errors contribute to many hospital deaths and serious adverse events (Kohn *et al.*, 2000).

Studies have shown that sleep quality and fatigue are important indicators of safety (Patterson *et al.*, 2010). Since safety is a primary concern for both the healthcare workers and the patients, the key strategy to reduce these risks is by making sleep a priority in the employer's systems of organizing work schedules and educate staff on ways to improve their sleep quality even when working on shift system. Analyzing the prevalence of fatigue within a healthcare organization is an essential first step for organizations that aim to implement stress reduction programs and establishing positive work environments for their workers.

Avoiding harm has always been central to medicine. If this study proves that sleep and fatigue is attributed to shift work, then it is adament that some policy changes to be made for the establishing a good safety culture in workplace. Any intervention explicitly designed to reduce error, and particularly any system-level intervention, plays a dual role: it directly aids care and it indirectly supports the development of a safety culture. With well rested, alert and energetic healthcare workers working at the front line in ED, medical professionalism and patients' safety will be ensured.

1.4 Objectives of Study

1.4.1 General Objective

To assess the quality of sleep and occupational fatigue level among the healthcare workers who are working on shift duty in the Emergency Department, Hospital USM.

1.4.2 Specific Objectives

- To determine the prevalence of different sleep quality levels among the healthcare workers who are working on shift in Emergency Department, Hospital USM.

- To determine the prevalence of occupational fatigue level among the healthcare workers who are working on shift duty in Emergency Department, Hospital USM.

- To determine the association between occupational fatigue and its contributing factors among the healthcare workers who are working on shift duty in the Emergency Department, Hospital USM.

1.5 **Hypothesis**

There are significant associations between occupational fatigue level and its contributing factors, such as years of working experience, age group, gender, sleep quality, family problems, health problems and work-related stress for healthcare workers who are working on shift duty in the Emergency Department, Hospital USM.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Fatigue is a common complaint of healthcare workers and fatigue impairs their performance. House staff, and many trainees (41%) say they have made errors that they attribute to fatigue (Gaba DM, 1994.). In addition, there is some evidence that house staff are at increased risk for motor vehicle accidents attributable to fatigue. (Marcus CL, 1996; Steele MT, 1999). The Institute of Medicine (IOM) report published in 1999 also revealed that thousands of patients are harmed each year by preventable error (Miller, 2010b).

The prevalence of fatigue among nurses in Cyprus was found at 91.9%. The prevalence of fatigue was higher in females (93%) compared to the males (87.5%) ($p = 0.003$). Most of the nurses in Cyprus believed that their fatigue was attributed to their work (55%), while 3.4% believed that their fatigue was due to their family, 29.3% pointed out that their stress was due to their work, family and health problems combined, 3.4% attributed their stress to their health problems and 8.9% to other factors ($p = 0.031$) (Raftopoulos *et al.*, 2012).

A study was done on fatigue level among 291 nurses in Hospital Universiti Sains Malaysia by Farah Nafeesha (Farah, 2012). Respondents in the study were chosen using random sampling method from both wards and clinics. The study showed that 164 out of 291 nurses (56.4%) in Hospital USM suffered from high fatigue, while the rest of 127 nurses (44.6%) experienced low fatigue. The relationship between fatigue with employment data was studied. The researcher found that years of working experience was associated significantly with fatique (*p*-value 0.04). Those with 10 or less years of working experience suffered higher fatigue. However, association between shift duty and fatique was not significant (*p*-value 0.227).

Table 2.1: Association between employment data and fatigue

Employment Data	**Low Fatigue (%) n=127**	**High Fatigue (%) n=164**	**P Value**
Work Experience			
Less than 5 years	27 (21.3%)	49 (29.9%)	0.043
6-10 years	14 (11.0%)	30 (18.3%)	
11-15 years	23 (18.1%)	27 (16.5%)	
More than 15 years	63 (49.6%)	58 (19.9%)	
Work in Shifts			
Yes	83 (65.4%)	118 (72.0%)	0.227
No	44 (34.6%)	46 (28.0%)	

Source: Farah, 2012

Table 2.2: Mean of Fatigue risk factors

Risk Factors Contributing Fatigue	**Mean (SD)**	**Overall Mean (SD)**
• Shift work schedule	2.74 (0.73)	3.02 (0.69)
• Improper work sc hedule	2.69 (0.70)	
• Uncomfortable work practices	2.85 (0.67)	
• Shorthanded	3.38 (0.74)	
• Work Stress	3.23 (0.76)	
• Functionally disorganized workplaces	2.90 (0.67)	
• Excessive Workload	3.18 (0.67)	
• High Expectations/ demands from patients and families	3.08 (0.67)	
• Inadequate rest	3.05 (0.55)	
• Improper sleep habit	3.09 (0.72)	

Source: Farah, 2012

Another study done in Hospital Universiti Sains Malaysia on Sleep Quality and coping styles among Diploma Nursing Students by Syazwani (Syazwani, 2011), found that 83 out of 123 participants (67.5%) suffered from poor sleep quality**.** Out of all the respondents, 38.2% had maladaptive coping skills. However, as this study was done among nursing students who were only doing attachment in the hospital, and they neither worked shift nor on-call, so their poor sleep quality might just be attributed to the stress of studies and exams.

In a study done by Machi *et al.* (2012), sleep quality was worse in EPs compared to the normal population, with 31% of subjects reporting poor sleep quality. On the other hand, Patterson PD (2010) also showed that poor sleep quality and fatigue are common among EMS workers in U.S. There is preliminary evidence that poor sleep quality and fatigue can jeopardize patient and provider safety in the EMS setting. Greater than half (55%) of respondents were classified as fatigued. Patterson et al identified 1.9 greater odds of injury (95% CI 1.1, 3.3), 2.2 greater odds of medical error or AE (95% CI 1.4, 3.3), and 3.6 greater odds of safety compromising behavior (95% CI 1.5, 8.3) among fatigued respondents versus non-fatigued respondents.

Studies in sleep laboratories showed that both at base line and after on-call duty, levels of daytime sleepiness in residents were similar to or higher than those in patients with narcolepsy or sleep apnea (Howard SK, 2002). In one study of pediatric house staff, 23% reported having fallen asleep while driving (81% while driving home after call), 44% had fallen asleep while stopping at a red light (100% after call), and 25% reported crashes. Another study examined accident risk in emergency department residents using a national survey with 957 respondents. A total of 96 crashes were reported in 76 residents (8%) and near-crashes were reported by 553 residents (53%). Notably, 74% of the crashes and 80% of the near crashes occurred following night shifts **(**Patterson *et al.*, 2010)**.**

Fatigue may also damage the well-being of the health care worker. Day shifts of 16 hours and night working are associated with a three-fold increase in occupational accidents with incidence increasing greatly after 9 hours of work. Needle stick injuries are increased three-, four-, and five-fold in ICU, Labour Ward, and the Emergency Department, respectively, during the night compared with daytime. Driving home after a long shift is more perilous for health workers who are twice as likely to report a road traffic accident compared to the general population (Gregory and Edsell, 2013).

There was another survey of interns' first postgraduate year to evaluate the risk for motor vehicle accidents with extended work shifts. They found an increased likelihood of motor vehicle accidents and near-miss accidents after extended work shifts and an increase monthly risk with increasing number of shifts (Barger LK, 2005). The survey by Gaba and associates revealed that more than 50% of respondents believed that they had made an error in clinical management that they thought was related to fatigue (Gaba DM, 1994.). A review of the first 10 years of the Australian Incident Management System reported that 2.7% of critical incidents were fatigue related. Additionally, the most common errors reported were drug errors which were four times more likely to occur if fatigued. A survey of New Zealand Anaesthetists reported that up to 86% of respondents had committed a medical error that they attributed to fatigue (Gander PH, 2000).

Up to 70% of shift workers complained of poor sleep or daytime somnolence. When compared with day workers, night staff report increased sleepiness at work, are less alert and perform less well on reasoning and vigilance tasks. Efficiency and accuracy of ECG and laboratory results interpretation have been shown to decline in both acute and cumulative sleep loss whilst intubation times are increased by 34% in sleep-deprived Emergency Department physicians on the night shift compared with day staff (Smith-Coggins R, 1994). Among recently retired anaesthetists, night shifts were identified as the most stressful aspect of anaesthetic practice and the most important reason for retirement (Katz JD, 1998).

2.2 SCIENCE OR STAGES OF SLEEP

Sleep is a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment that is usually accompanied by postural recumbency, quiescence, closed eyes, and other indicators commonly associated with sleeping. Several different functions occur during sleep, such as repair and growth, learning or memory consolidation, and restorative processes (Curcio G, 2006). Sleep research shows that the average adult needs, a range of 7 to 9 hours of sleep each night, teenagers need about 9.5 hours, and infants generally require around 16 hours per day (Ferrara M, 2001). Sleep quality is defined as one's satisfaction of the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity, and refreshment upon awakening (Kline).

Sleep cycles are composed of two phases: non-rapid eye movement (NREM) and rapid eye movement (REM). NREM sleep is further divided into four stages (stages I, II, III, IV). Sleep is initiated during stage 1. During this stage, physiological responses, for example body temperature and muscle relaxation, begin to slow down. Stages II, III, and IV comprise what is known as “true sleep.” The deepest sleep occurs during stage IV. This stage is characterized by the lowest oxygen consumption and the greatest difficulty awakening a person. REM sleep, the latter phase, is characterized by an increase in central and peripheral nervous system activity (O'Connor and Youngstedt, 1994). During this phase of sleep blood flow is increased, heart rate and blood pressure are increased, and dreaming frequently occurs. As previously mentioned, adults usually obtain 7-8 hours of sleep per night. Approximately 75% of a usual night’s sleep is NREM. Stage I comprises ~5%, stage II comprises of ~50%, stages III and IV combined comprise ~20%. REM sleep comprises ~25% of sleep. A NREM-REM cycle occurs within a period of 90 minutes. There are usually four to six NREM-REM cycles during a night’s sleep (Knapp-Spooner and Yarcheski, 1991).

2.3 SLEEP QUALITY ASSESSMENT TOOL

2.3.1 Sleep Quality Index

Sleep quality was assessed with the Sleep Quality Index (SQI; Urponen, Partinen, Vuori, & Hasan, 1991), a validated brief questionnaire containing 8 items to indicate the frequency of various sleep disturbances per week for the past 3 months. The SQI consists of eight items with three response categories weighted 0, 1, or 2, with 2 indicating the most common or severe symptom. SQI developers report that summed scores on the eight items provide a total sleep quality score. Higher scores on this measure indicate poorer quality of sleep. They categorize sleep quality based on scale scores as follows: 0-1 = good sleep quality, 2-8 = occasional sleep difficulties and 9-16 = poor sleep quality.

The SQI has been widely used by researchers as a sleep quality assessment tool throughout the world as it had been proven to be a reliable and valid tool. SQI has recorded with acceptable reliability of Cronbach's alpha score of 0.71 in a US sample (Buboltz *et al.*, 2009), 0.74 in a European sample (Urponen *et al.*, 1991) and 0.86 in Malaysia population (Syazwani, 2011). Furthermore, a significant relationship between quality of sleep and subjective health has been reported (Urponen *et al.*, 1991). The SQI items were approved by the Institutional Review Board at East Carolina University and had been added to the National College Health Risk Survey (NCHRS) for administration of the survey in the year 2006. Chung and Cheong also used SQI to evaluate sleep- wake patterns and sleep disturbance among Hong Kong Chinese adolescence (Chung and Cheung, 2008).

2.3.2 Epworth Sleepiness Scale

The Epworth Sleepiness Scale (EES) is a simple, standardized, self- administered eight-item questionnaire that has been proposed as a simple method for measuring daytime sleepiness or sleep propensity in adults (John, 1991). The questionnaire reasonably reliable in the test-retest sense, and, it has a high level of internal consistency as measured by Cronbach's alpha of 0.88 (Johns, 1992).

The ESS is a short questionnaire including eight items within individual rates on the likelihood that they would doze in eight common, quiescent situations. The response rate were ranged between 0 (would never doze) and 3 (high chance of dozing). Thus, the subject is asked to characterize, retrospectively, part of his usual behavior in a variety of situations that are more or less soporific. Subjects are asked to distinguish dozing behavior from feeling of tiredness. The EES score is the sum of eight-item scores and can range from 0 to 24. A sum of 9 or more from the eight individual scores reflect “very sleepy and should try to find medical advice.

2.3.3. The Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire which assesses sleep quality and disturbances over a 1-month time interval. The PSQI is a 24-item questionnaire. It is divided into seven components; sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications and daytime dysfunction. The scores in seven subscales ranged between 0-3 (0= Not during the past month; 1= Less than once a week; 2= Once or twice a week; 3= Three or more times a week). The sum of scores for these seven components yields one global score. A global PSQI score > 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, $p \leqslant 0.001$) in distinguishing good and poor sleepers.

The clinemetric and clinical properties of the PSQI suggest its utility both in psychiatric clinical practice and research activities. (Buysse *et al.*, 2003). This instrument has been validated among female sexual assaults survivors (Germain et al., 2005) and has been used among earthquake survivors and military veterans (Farrahi J, 2009 Aug; Insana SP, 2012 Mar). The alpha coefficient for PSQI was 0.88.

2.4 FATIGUE

Fatigue can be defined as a subjective feeling of tiredness that is physically and mentally penetrative. It ranges from tiredness to exhaustion, creating an unrelenting overall condition that interferes with individuals' physical and cognitive ability to function to their normal capacity. It may result from a period of intense or prolonged exertion or alternatively may occur after time spent on unchallenging or monotonous tasks. In clinical practice, it is associated with long hours of wakefulness, sustained mental effort, and shift working. Fatigue negatively affects performance and is associated with increased risks to patient safety and to the well-being of the health care provider (Gregory and Edsell, 2013). It can be influenced by several factors: namely, physiological (e.g. circadian rhythm); psychological (e.g. stress, alertness, sleepiness), behavioral (e.g. pattern of work, sleep habits, quality of rest); and environmental (e.g. work demand, boredom).

2.5 FATIGUE LEVEL ASSESSMENT TOOL

De Vries et al had done a study to compare the psychometric qualities of several fatigue questionnaires in a sample of working persons (De Vries *et al.*, 2003). This was done through a strength-weakness analysis that focused on exploring and testing: (1) internal consistency and test-retest reliability; (2) content validity; (3) convergent validity; and (4) the dimensionality of the fatigue instruments. The questionnaires were selected on the basis of their use in working and healthy populations, and most were part of the prescribed set of fatigue questionnaires used in a nationwide project. In this study, all the selected questionnaires including: Checklist Individual Strength (CIS), Fatigue Scale (FS), Fatigue Assessment Scale (FAS) were found reliable, valid, and frequently employed (De Vries *et al.*, 2003). Cronbach alpha is a general formula for estimating the reliability of a test by looking at inter-item consistency. It measures how well a set of items measures a single unidimensional latent construct.

All studied fatigue questionnaires had a good reliability. In addition, the content validity of the unidimensional measures was good, while the multifaceted structure of the other instruments (CIS and FS) could not be replicated. The convergent validity of all measures was good. Lewis and Wessely assume that, when fatigue is measured with emotional, behavioural, and cognitive components, it is likely that the concept is multidimensional (Lewis G, 1992). This view also reflects idea of Smets and colleagues (Smets EMA, 1995) who have stated that nowadays there is general agreement to measure fatigue as a multidimensional concept.

2.5.1 Checklist Individual Strength-20 (CIS-20)

The Checklist Individual Strength-20 (CIS-20) consists of 20 statements and provides a total fatigue score and scores for four components of fatigue: subjective experience of fatigue (SEF; eight items), reduced concentration (CON; five items), reduced motivation (MOT; four items), and reduced physical activity level (PA; three items). Respondents use a seven point rating scale (1, yes, that is true, to 7, no, that is not true). A total score above 76 is considered high.

The reliability of the CIS is good (Vercoulen JHMM, 1999). Although the CIS was developed for chronic fatigue syndrome patients, the questionnaire is claimed to be also appropriate for healthy populations (Beurskens *et al.*, 2000). The CIS was tested thoroughly in the clinical setting among patients with chronic fatigue syndrome and other chronic diseases and healthy controls (Meijman TF, 1996; Vercoulen JHMM, 1999). The internal consistency of the CIS seemed to be good: Cronbach’s score for the total CIS was 0.90 and for the scales ranged from 0.83 to 0.92 (Vercoulen JHMM, 1999). Furthermore, the subscales of the CIS correlated significantly with comparable scales (Vercoulen JHMM, 1999).

2.5.2 Fatigue Severity Scale (FS)

Fatigue Severity Scale has been used to measure fatigue severity in a manner that facilitates research in the experience of fatigue in a variety of medical and neurologic disorders. It contains nine statements concerning respondent's fatigue, e.g., how fatigue affects motivation, exercise, physical functioning, carrying out duties, interfering with work, family, or social life (Schwartz JE, 1993).

The scale for each statement has a 7-point Likert scale where 1 represents 'Strongly Disagree' and 7 represents 'Strongly Agree'. The responses will be summed up and divided by number of items for scale score. Therefore, the score range will be 1–7. Higher score indicates more severe fatigue (Neuberger, 2003).

This FFS was found to have high reliability with Cronbach's Alpha of 0.89 for SLE subjects, 0.81 for MS subjects and 0.88 for normal healthy adults (Krupp LB, 1989). Test-retest done (2 time points separated by 5–33 weeks) showed no significant changes in FSS scores when no clinical change was expected (Krupp LB, 1989). This scale was proven to be valid as 98% of MS subjects correctly classified and 90% of SLE subjects correctly classified versus normal controls (Krupp LB, 1989).